

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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|-----------|---|-----------------------|--------------------------|
| Applicant | : | Schuegraf |) Group Art Unit Unknown |
| | | |) |
| Appl. No. | : | Unknown |) |
| | | |) |
| Filed | : | Herewith |) |
| | | |) |
| For | : | RUGGED METAL |) |
| | | ELECTRODES FOR METAL- |) |
| | | INSULATOR-METAL |) |
| | | CAPACITORS |) |
| | | |) |
| Examiner | : | Unknown |) |

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to examination on the merits, please amend the above-captioned application as indicated below:

IN THE SPECIFICATION

On page 1, after the title, please add the following heading and paragraph:

--Reference to Related Application

The present application is a continuation of U.S. Application Serial No. 09/161,156, filed September 25, 1998, which is a division of U.S. application No. 08/943,222, filed October 6, 1997, which is a file wrapper continuation of U.S. Application No. 08/576,952, filed December 22, 1995.--

IN THE CLAIMS

Please delete Claims 13-19.

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1. (Amended) A method of forming a [textured] rugged metal structure comprising the steps of:

forming a [textured] rugged structure comprised of substantially silicon atoms; and replacing silicon atoms in the [textured] rugged structure with metal atoms.

2. (Amended) The method of Claim 1, wherein the step of forming a [textured] rugged structure comprises:

depositing an amorphous or polycrystalline silicon structure by chemical vapor deposition; and

annealing the silicon structure to form a silicon surface having a [textured] rugged surface morphology.

3. (Amended) The method of Claim 1, wherein the step of replacing silicon atoms with metal atoms comprises exposing the [textured] rugged structure to a refractory metal-halide complex.

4. (Amended) The method of Claim 3, wherein the [refractor] refractory metal-halide complex comprises WF₆.

5. (Amended) The method of Claim 4, further comprising the step of chemically oxidizing the [textured] rugged structure prior to exposing the [textured] rugged structure to the refractory metal-halide complex.

6. (Amended) A process for fabricating a metal-insulator-metal capacitor on a semiconductor wafer comprising the steps of:

forming a silicon electrode structure on the semiconductor wafer;
[texturizing] making the silicon electrode structure rugged; and
replacing the silicon in the silicon electrode structure with a metal, thereby forming a [textured] rugged metal electrode.

7. (Amended) The process of Claim 6, further comprising covering the [textured] rugged metal electrode with a dielectric layer having a high dielectric constant.

20. (Amended) A method of forming an integrated circuit capacitor comprising:

forming a metal electrode having a [textured] rugged surface;
covering said [textured] rugged surface with a dielectric; and
covering said dielectric with a second electrode.

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Please add the following new claims:

21. (Added) The method of Claim 1, wherein the rugged structure of substantially silicon atoms comprises a hemispherically grained silicon structure.
22. (Added) The process of Claim 6, wherein making the silicon electrode structure rugged comprises seeding and annealing to form a hemispherically grained silicon layer.
23. (Added) The method of Claim 20, wherein forming the metal electrode comprises providing a hemispherical grain silicon morphology.
24. (Added) The method of Claim 20, wherein forming the metal electrode comprises forming a rugged silicon layer and converting the silicon layer to metal.

REMARKS

Applicant has amended the claims to address the Examiner's objections, in the parent application, to the term "textured" as being non-limiting. In particular, the Examiner stated that a layer could have a smooth texture and meet the claims as filed. While Applicant traverses this finding and submits that "textured" will be understood in view of the specification to exclude a smooth surface, Applicant nevertheless amends the claims to facilitate prosecution.

The Examiner also rejected the claims in the parent application. In a statement of reasons for allowance accompanying the Notice of Allowance, the Examiner cited Batra (U.S. Patent No. 5,770,500) at Col. 2, lines 55-60 for teaching replacing silicon atoms in a rugged structure with Ge atoms in a halide atmosphere. The Examiner then allowed the claims upon amendment to recite a replacement reaction by "exposing the structure to a metal-halide" because "[I]t would not have been obvious to replace the Ge halide complex taught by Batra with the metal halide disclosed by the applicant" Notice of Allowance, Application No. 09/161,156.

Applicant respectfully traverses the findings and submits that they are inconsistent. The claims as originally filed all recite forming a rough metal electrode. Batra does not teach such an electrode, but rather taught a rugged Ge-doped silicon layer.

In view of the foregoing amendments and remarks, Applicant submits that the application is in condition for examination on the merits and respectfully requests the same. If, however,

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some issue requires further clarification, the Examiner is cordially invited to call the undersigned to discuss the same.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: January 26, 2001

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